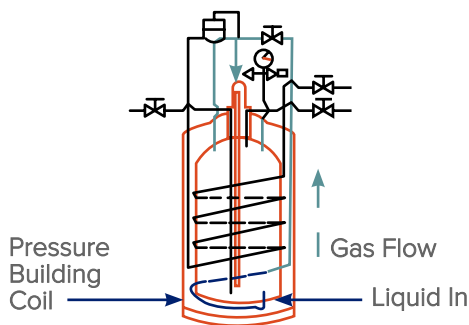


Proper Operations of Liquid Dewar

One of the backbones in our arsenal of gas product is the liquid dewer. For an industrial, medical, laboratory, beverage, etc. gas users of 5 or more high pressure dewer of a specific gas type per week, a money saver may be converting to a liquid container. And for those of you that have made that discovery, we would like to review the proper use and operating procedure of liquid dewer.

Liquid dewer What are they? When are they safe in application? How do they work? Where are they used?



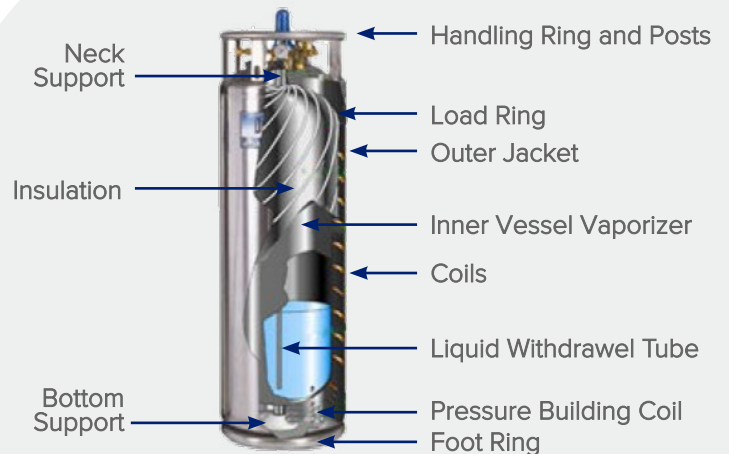
What are they? Liquid Dewers are large, insulated, thermos bottles used to store atmospheric gases in their liquid state. These dewer have had many different names by distributors and manufactures: Dewars, VGL, LS, Liquid Cans etc. They are delivered in different sizes and configurations and may contain a variety of products including nitrogen, oxygen, argon, carbon dioxide, helium, nitrous oxide and hydrogen. Each Dewar, depending on the size, could store up to the equivalent of 20 high pressure dewer.

When are they safe in application? These containers are constructed in accordance with DOT regulations to ensure the safe shipping and usage at our customer locations.

- > The liquid content is very cold, down to -400 degrees F. Therefore, when working with this product, safety glasses, face shields, and gloves are required for skin protection. An understanding of the safe handling of cryogenics is mandatory.
- > Containers have externally mounted safety devices that protect them from over pressurization. Why? When these cold liquids turn to gas they will expand approximately one hundred times in volume.
- > Because of the potentially high volume releases of product, understanding physical properties of each gas is critical. For example, large quantities of oxygen, an oxidizer, in the presence of hydrocarbons can cause explosions. Nitrogen, carbon dioxide, argon, and helium displace oxygen causing possible asphyxiation. And, of course, you probably know the hallucinatory effects of nitrous oxide.

How do liquid dewer work? There are four separate piping circuits on a typical Dewar:

Pressure Building Circuit

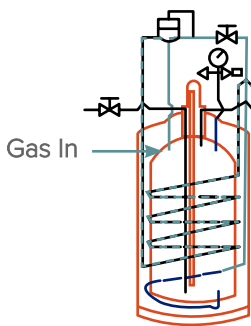


> Pressure Building Circuit

The Pressure builder is used when the demand for gas or liquid is greater than the Dewar's natural productive capacity. This circuit builds gas pressure by removing liquid from the bottom of the tank, and passing it through a coil that is soldered to the outer skin of the tank. The exposure to heat from contact to the tank exterior causes the liquid to convert to a gaseous state as it moves back to the top of the tank. A pressure building regulator controls the gas flow in this circuit. (See dissection on 1st page.)

> Economizer Circuit

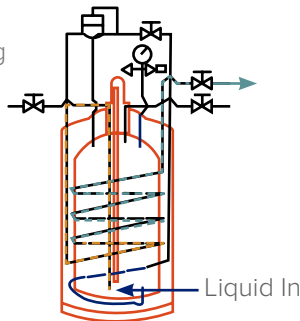
This circuit is activated when the Dewar has been sitting idle for a period of time. Due to inherent heat losses, all Dewars will build a certain amount of pressure when not used. A tank that at 150 psi on Friday, may be at 220 psi on Monday. This circuit affords the use of the excessive pressure before resuming the building of pressure.



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> Gas Use Circuit

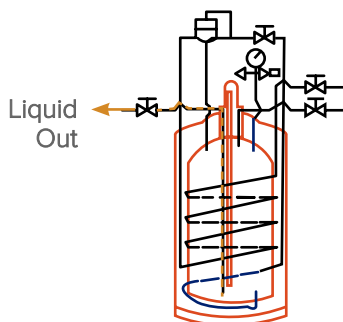
Similar to the pressure building circuit, liquid is taken from the bottom of the inner vessel and run through multiple coils that are soldered to the outer vessel, to produce gas. This gas is available for low or high pressure applications.



> Liquid Withdrawal Circuit

This circuit takes liquid from the bottom of the tank and delivers it directly to the liquid valve for customer use. In addition to these four circuits, there is also a vent valve on the top of the tank that gives the end user or supplier the ability to vent the head pressure off of the tank for service or filling.

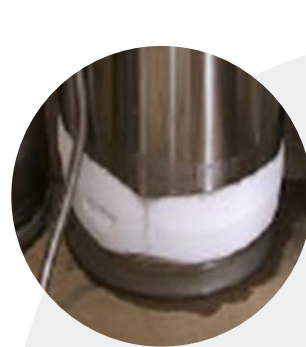
All tanks are supplied with a pressure relief valve for maintaining safe tank pressure for specific applications. Typically, these are shipped to



the customer at 22 psi for liquid withdrawal, and up to 350 psi for higher pressure requirements. When the pressure in the tank reaches its release point, this valve will evacuate the excessive pressure. When the pressure falls back below these levels, the valve closes again.

Finally, there is also a contents gauge indicating the liquid level.

Where are they used? The gas or liquid inside is used for many different cryogenic applications such as freezing and/or storing of specimens, radical temperature cyclic testing, cold machinery, shrinking metals in the fabrication process, etc. Gas vapor blanket environments are applied for protection from the atmospheric conditions in electronic, medical, and laboratory applications. Gas conversion for cryogenic liquid storage is required for high volume, automated oxyfuel, plasma, and laser cutting.



If you think something has gone wrong, just remember:

- > The Pressure Gauge indicates pressure inside the inner tank. Opening the Pressure Building Valve increases tank pressure to normal operating levels.
- > The Gas-use Valve allows gas to flow from the tank.
- > The Economizer Circuit minimizes product loss.
- > To draw liquid, close the Gas-use and Pressure Building Valves, and open the Liquid-use Valve.
- > If you need to know exactly how much liquid is in your dewar, use a Digital Gauge.
- > Frost and ice are nothing to be scared about.